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# Specifying main characteristics of five Iranian local cultivars of almond (*Prunus dulcis* Mill.)

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**For introducing five Iranian local cultivars of almond *Sahand*, *Shokufe*, *Azer*, *Yalda* and *Monagga,* a primary study was carried out on some major characteristics of them. *Sahand* cv. with 9100 G.D.H. (Growth Degree Hours) heating and 384 C.U. (Chilling Unit) chilling requirements operated as the latest bloom (middle April). Also, *Shokufe* cv. as earlier ripen (late August), *Azer* cv. as more productive (654 kg/h kernel) and easier harvest and *Monagga* cv. as earlier bloom (middle March) were specified in this study. Variance analysis of kernel and shell dimension and weight, the ratio of kernel/shell weight, number of spurs on branches and flower bud number in spurs showed the significant differences among cultivars (P≤5%) whereas differences in amount of carbohydrates, proteins and lipids of kernels were non-significant.**

***Keywords:*** *Almond cultivars, chilling, heating, spur, kernel, shell*

## INTRODUCTION

Based on the statistics of F.A.O organization (http://www.fao.org/faostat), Iran produces about 110,000 t/year almond crops in over 172,000 h areas and in this respect is the fourth country in the world (figure 1).

Almond is one of the oldest crops in Iran and this country with its nearby regions are counted as diversity and development centers for different almond species (Ladinsky, 1999; Gahraman, 2002; Chaichi, 2005). Regarding to this matter, studying and selecting promising genotypes among native almond population has been followed in the national breeding program of almond in Iran from fifty years ago.

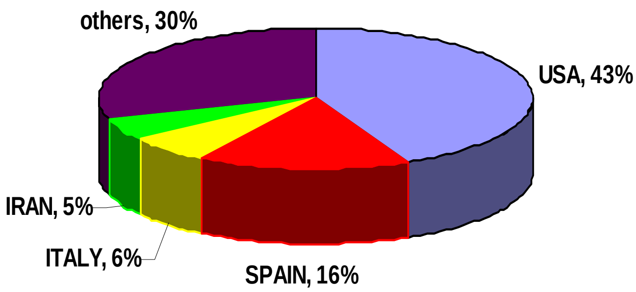



**Fig. 1.** Iran's share of global production of almond

The main aims of this program are achievement to high productivity, high kernel quality, shell softness, late blooming date and toleration against environmental stresses. Although, many commercial cultivars of almond including: Texas, Ferragnes, Nonpareil, Marcona, Masbouvera, etc. (Westwood, 2009) and tolerant rootstocks such as GF677, GF557, Hansen 536, Hansen 2168 (Kester and Asay, 1986), Alnem 1, Alnem 88, Alnem 201, etc. (Kochban and Spiegel-Roy, 1976) have already been introduced in the world but some of them are not adapted perfectly with Iran's conditions. On the other hand, at present many local cultivars have been planted in extensive areas of different regions of Iran that mostly are early bloom and so lose all or portion of their crop due to late frost damage. Therefore, investigations to obtaining new superior cultivars with mentioned characteristics above have been followed continuously up to now.

## MATERIALS AND METHODS

This study was carried out on five local cultivars of almond named; *Sahand*, *Shokufe*, *Yalda*, *Azer*, *Monagga* and *Nonpareil* cv. (as control) at the *Sahand horticultural research station* located in 25 km of southwest of Tabriz with 37º,55´ latitude, 45º,57´ longitude and 1350 m altitude. The studied characteristics included; full blooming date, easy harvesting, the spur numbers on each meter of yielded branches, flower bud number in each spur, ripening date, tree chilling requirement, location of flower buds, heat requirement for opening flower buds, suitable pollenizer, vigor and form of tree, shell softness, shell and kernel dimensions and weights, double kernel percentage, the ratio of kernel/shell weights and the amount of lipids, proteins and carbohydrates of kernels. The characteristics of shell softness, tree form and vigor, easy harvesting were ranked according to *I.B.P.G.R.* (*International board for plant resources*) descriptors, tree chilling and heating requirements with *Spark* method (Spark, 1993) and others were recorded based on statistical methods.

## RESULTS AND DISCUSSION

The tables 1 and 2 show the results of recorded attributes in relation with tree and fruit of studied almond cultivars respectively. *Sahand* cv. was later bloom than others (middle April) and so produced economic crop under late spring frost conditions. Also, recording chilling and heating requirements of each cultivar showed this cultivar had the highest rate of both kinds. Although, *Shokufe* cv. had 200 C.U. chilling and 5700 G.D.H. heating requirements respectively and it seemed to be an early or middle bloom cultivar, but it operated as a late bloom. That might be resulted from the slow temp reaction of flower buds or late beginning of physiological dormancy and or both of them. However, *Monagga* cv. as a typical early bloom cultivar had less dormancy period than other cultivars conformity with its low chilling requirement. Also, was not observed significant differences among the full blooming date of *Yalda*, *Azer* and *Nonpareil* cvs. and the flowers of them were opened almost in the same time (early April).

**Table 1.** Tree characteristics of five Iranian local almond cultivars

| Characteristics | Cultivars | | | | | |
|---|---|---|---|---|---|---|
| | ***Sahand*** | ***Yalda*** | ***Shokufe*** | ***Azer*** | ***Monagga*** | ***Nonpareil (Cont.)*** |
| **Full blooming date** | Middle April | Early April | Middle April | Early April | Middle March | Early April |
| **Ripening date** | Middle September | Middle September | Late August | Early September | Late August | Late August |
| **Easy harvesting** | Intermediate | Relatively low | Low | Relatively high | Intermediate | Intermediate |
| **Tree vigor & form** | Strong, Upright | Strong, Spreading | Strong, Spreading | Intermediate, Spreading | Intermediate, Spreading | Intermediate, Spreading |
| **Pollenizer** | Ferragnes, Shokufe | Azer | Ferragnes, Sahand | Nonpareil, Shokufe | Mamae, Sefid | Yalda, Azer |
| **Location of flower buds** | Mostly on spurs | Mixed | Mostly on shoots | Mixed | Mixed | Mostly on shoots |
| **Flower bud number in spur** | 4.60 a | 3.99 ab | 2.58 c | 3.70 ab | 3.60 b | 3.55 b |
| **Spur number on branch** | 46.34 a | 37.92 ab | 25.67 b | 38.50 a | 40.33 a | 31.01 b |
| **Chilling req. (C.U)** | 384 | 220 | 200 | 329 | 50 | 300 |
| **Heating req.(G.D.H)** | 9100 | 5700 | 5700 | 6500 | 5800 | 7300 |

**Table 2.** Fruit characteristics of five Iranian local almond cultivars

| Characteristics | | Cultivars | | | | | |
|---|---|---|---|---|---|---|---|
| | | ***Sahand*** | ***Yalda*** | ***Shokufe*** | ***Azer*** | ***Monagga*** | ***Nonpareil (Cont.)*** |
| **Shell softness** | | Hard | Soft | Soft | Intermediate | Soft | Soft |
| **Shell dimension (mm)** | **Length** | 24.2 | 18.3 | 17.8 | 20.0 | 18.1 | 17.7 |
| | **Width** | 35.0 | 36.9 | 25.4 | 28.7 | 28.6 | 32.0 |
| **Shell weight (g)** | | 4.25 | 1.96 | 1.32 | 2.51 | 1.64 | 1.62 |
| **Kernel dimension (mm)** | **Length** | 24.2 | 27.8 | 20.0 | 23.2 | 22.2 | 25.0 |
| | **Width** | 15.5 | 11.2 | 11.0 | 13.2 | 12.1 | 12.2 |
| | **Thickness** | 7.80 | 7.20 | 7.65 | 8.42 | 8.54 | 7.55 |
| **Kernel weight (g)** | | 1.18 a | 1.07ab | 0.78 b | 1.01 ab | 0.98 b | 1.12 a |
| **Kernel /Shell (%)** | | 27 | 55 | 58 | 43 | 60 | 68 |
| **Double kernels (%)** | | 16 | 3 | - | 4 | 2 | 10 |
| **Lipids (%)** | | 51.9 | 52.4 | 58.2 | 60.1 | 56.7 | 53.8 |
| **Proteins (%)** | | 21.9 | 20.8 | 22.5 | 20.1 | 20.2 | 18.9 |
| **Carbohydrates (%)** | | 19.8 | 20.1 | 19.2 | 19.6 | 20.7 | 20.4 |

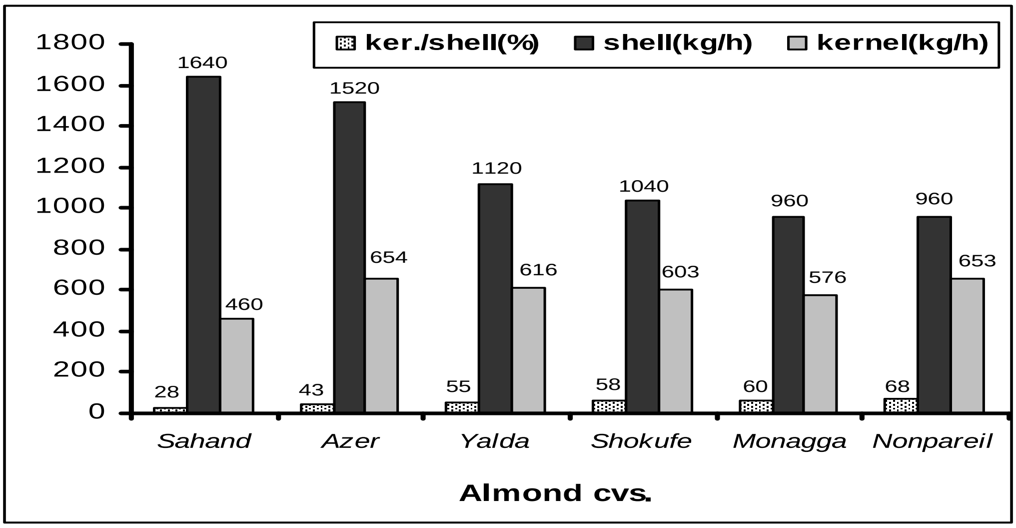



**Fig. 2.** Yielding rate of Iranian almond cultivars.

Pull off force of fruits was recorded for evaluation of easy harvesting and results showed that *Azer* cv. with -11.2 N harvested easier whereas *Shokufe* cv. with -22.6 N was harder from this viewpoint. This parameter may be important for adjustment of shakers in mechanical harvesting.

So, as the studied cultivars were incompatible, it became necessary to determinate some suitable pollenizers for them. It was carried out after isolation of at least 500 flower buds from each one and inoculation of them with some cultivars pollen. In this way, the best compatible pollen was specified by counting formed fruits at the end of season.

All experimental trees have been grafted on native almond seedlings and it may be considerable about obtained data for the characteristic of tree vigor and form. Also, statistical analysis of spur number on branches, flower bud number in each spur, shell and kernel sizes and their weights showed the significant differences among cultivars at 5% probability level (tables 1, 2). However, differences among cultivars were not significant in relation with the amount of lipids, proteins and carbohydrates of kernels.

The comparison of studied cultivars performance with *Nonpareil* cv. revealed that they could be to use for commercial aims. The difference of yielding rate (kernel) of *Azer* and *Yalda* cvs. with control was non-significant (figure 2). Although, *Sahand* cv. produced lower kernel but based on regional observations, it had the best acclimation with Azerbaijan conditions and its toleration against late frost damage and stable productivity generally compensated differences of yielding.

## REFERENCES

**Chaichi S.** (2005) An analysis on almond breeding in Iran. IV Int. Symp. Pistachios and almond. Iran: Tehran, p. 2

**Gahraman A.** (2002) Flora of Iran. Tehran: Research Institute of Forests and Rangelands of Iran Publications, 1123 p.

http://www.fao.org/faostat - Database Results, 2009.

**Kester D., Asay R.N.** (1986) ‘Hansen 2168’ and ‘Hansen 536’ two new hybrid rootstocks. Hort. Sci., **2(21):** 331-332.

**Kochbah J., Spiegel-Roy P.** (1976) ‘Alnem 1’, ‘Alnem 88’ and ‘Alnem 201’ almonds: Nematode-resistant rootstock seed sources. Hort. Sci., **11(3):** 720.

**Ladsinsky G.** (1999) On the origin of almond. Genetic Resour. Crop Eval., **42(2):** 143-147.

**Spark S.D.** (1993) Chilling and heating model for pecan bud-break. J. Amer. Soc. Hort. Sci., **1(118):** 29-35.

**Stebbins R.L.** (1981) A review of rootstocks for stone fruits. Ore. Hort. Soc. Ann. Rep., p. 23-30

**Westwood M.N.** (2009) Temperate-zone pomology, physiology and culture. New York: Timber Press, USA, 536 p.

**H. Rahnemoun**

**İranın Beş Yerli Badam (*Prunus dulcis* Mill.) Sortunun Əsas Xüsusiyyətlərinin Müəyyənləşdirməsi**

**Xulasə**

Tədqiqatlar İranın *Səhənd*, *Azər*, *Şukufə*, *Yəlda* və *Monəqqa* adlı beş yerli badam sortlarının istehsala buraxılması üçün onların əsas xüsusiyyətləri üzərində aparılmışdır. Əldə edilmiş nəticələrə əsasən, *Səhənd* sortu 9100 G.D.H (İnkişaf dərəcəsi saatı) istilik və 384 C.U (soyuqluq vahidi) soyuqluq tələb etməklə özünü ən gec çiçəkləyən (Aprelin ortasında) sort kimi göstərmişdir. Həmçinin *Şukufə* sortu ən tez yetişən sort (Avqustun sonunda), *Azər* sortu məhsuldar (654 kq/ha) və asan yığılan sort və *Monəqqa* sortu ən tez çiçəkləyən sort (Martın ortasında) kimi göstərilmişdir. Hesablanmış variasiyaların analizinə görə, qeyd olunan sortların arasında dənə və çəyirdəyin ölçüsü və çəkisi, budaqların uzərindəki tumurcuq, habelə onların içində yerləşən çiçək gönçələrinin sayı kifayət gədər fərqli olmuşdur ($p \leq 0.05$). Lakin, dənədə karbohidratların, zülalların və lipidlərin orta qiymətlərinin arasında ciddi fərq görünməmişdir.

**Определение Основных Особенностей Пяти Иранских Местных Сортов Миндаля (Prunus Dulcis Mill.)**

Исследования были проведены на основе основных особенностей пяти иранских местных сортов миндаля Саханд, Шукуфе, Азер, Ялда и Монагга для выпуска на производство. Основываясь на полученные результаты сорт Саханд с 9100 G.D.H. (часы степени роста) к теплу и 384 C.U (показатель холода единица охлаждения) к холоду требовательный показал себя как сорт с самым поздним цветением (в середине апреля). Кроме того, сорт Шукуфе показан как самый раносозревающий (в конце августа), сорт Азер как продуктивный (654 кг/ч ядра) и легко собираемый и сорт Монагга как самый раноцветущий (в середине марта). По анализу рассчитанных вариаций размер и масса семени и косточки, соотношение веса семени / косточки, число расположенных на ветках почек и число цветочных бутонов в почках среди указанных сортов оказались достаточно различными ($P \leq 5\%$), в то время как различия в количестве углеводов, белков и липидов в семени были незначительным.